PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-231363
(43)Date of publication of application : 07.09.1993

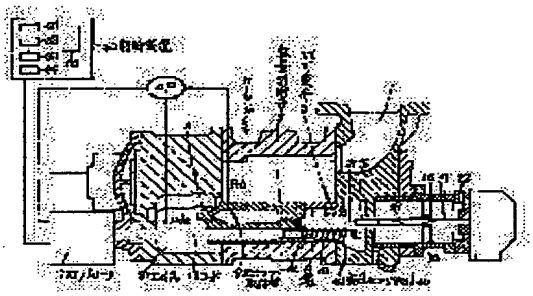
(51)Int.Cl. F04C 18/16
F04C 29/00
F04C 29/10

(21)Application number : 04-033582
(22)Date of filing : 20.02.1992

(71)Applicant : MAYEKAWA MFG CO LTD
(72)Inventor : KAWAMURA KUNIAKI
IKEHARA MASACHIKA

(54) VI VARIABLE SCREW TYPE COMPRESSOR

(57)Abstract:
PURPOSE: To promptly and accurately determine the optimum Vi with a simple constitution by driving a Vi variable valve by utilizing a step motor, in a screw type compressor using a volume control valve and the Vi variable valve.
CONSTITUTION: A parameter of suction pressure, delivery pressure, etc., is trend- analyzed by a control unit of providing a data recorder and an arithmetic unit. The optimum Vi is estimated, and its signal is input to a step motor 7 to drive a rod 11 rotated, so that a Vi variable valve 6 screwed to this rod 11 is adjusted. A pressure of fluid just before starting delivery is detected to adjust the Vi variable valve 6 by giving the signal to the step motor 7 so as to minimize a difference between this pressure of fluid just before starting delivery and the delivery pressure.



LEGAL STATUS

[Date of request for examination]	10.02.1999
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3159762
[Date of registration]	16.02.2001
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

CLAIMS

(57) [Claim(s)]
[Claim 1] In Vi adjustable screw mold compressor which has a capacity control valve for making adjustable Vi adjustable valve and the inhalation volume for making the design volume ratio Vi adjustable, and making an inhalation flow rate adjustable While forming a male screw in the rod which penetrates a capacity control valve, forming a scalpel screw in Vi adjustable valve and being made to drive Vi adjustable valve by rotation of said rod Vi adjustable screw mold compressor which attaches a step motor in said rod of the exterior of casing, drives this motor with an external signal, and enabled it to change Vi automatically.
[Claim 2] Vi adjustable screw mold compressor according to claim 1 which gives a signal to a step motor so that the difference of the pressure and discharge pressure which attach a pressure sensor in a casing wall side just before the space made from Rota and a casing wall is open for free passage with regurgitation space, and are detected by this pressure sensor may be made into min, in order to set up Vi from which need power serves as min.
[Claim 3] Vi adjustable screw mold compressor according to claim 1 which performs inclination analysis, predicts Optimum Vi and sets Vi adjustable valve as this value of Vi with the control unit equipped with the data recorder and the arithmetic unit for parameters, such as suction pressure of the system by which a screw mold compressor is operated, and a discharge pressure.
[Claim 4] the slot which the taper attached to Vi adjustable valve -- preparing -- the casing exterior -- a variation rate -- Vi adjustable screw mold compressor according to claim 3 which attaches a sensor so that the clearance between this slot may be detected, and pinpoints Vi adjustable valve position with the variation rate of this clearance.

[Translation done.]

* NOTICES *
JPO and NCIPI are not responsible for any
damages caused by the use of this translation.
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to Vi adjustable screw compressor which has Vi adjustable valve for making adjustable the setting volume ratio Vi which is a ratio of the inhalation volume of a screw mold compressor, and the regurgitation volume, and a capacity control valve for making the inhalation volume adjustable and making an inhalation flow rate adjustable.
[0002]
[Description of the Prior Art] The method of moving a capacity control valve and Vi adjustable valve was taken by conventionally moving a piston to it by differential pressure with a background pressure (mainly inlet pressure) using the adjustment with which all consist a capacity control valve and Vi adjustable valve of a cylinder and a piston, respectively, applying oil pressure to a piston.
[0003] Moreover, conventionally, suction pressure and a discharge pressure were detected, the central value

of the ratio of specific beat of [redacted] was used and calculated to the ratio, and [redacted]mum Vi was decided. namely, P1 .... suction pressure P2 .. a discharge pressure K .. the time of being referred to as ratio-of-specific-beat =Cp / Cv -- P1 V1 K =P2 V2 KP2 / P1 -- the optimal by P2 / =[V2] KV1 / V1 / V2 =[P1] 1/K -- Vi was decided.

[0004]

[Problem(s) to be Solved by the Invention] Conventionally, since the cylinder and the piston were used in order to move Vi adjustable valve, the drive of Vi adjustable valve became the structure which projects in the exterior of a compressor, for this reason, the compressor was complicated, and the hydraulic line etc. was many.

[0005] Moreover, conventionally, since Vi adjustable valve was moved by moving this piston by differential pressure with inlet pressure (mainly), forming the same drive also in Vi adjustable valve, and applying oil pressure to a piston when used for moving a capacity control valve as mentioned above, the amount of a motion and a rate did not become fixed but a setup of the optimal location of Vi was difficult.

[0006] By making it move approximately with the rod which drives Vi adjustable valve with a step motor, this invention can be manufactured cheaply, and actuation is trustworthy and it operates correctly. Moreover, it aims at obtaining Vi adjustable screw mold compressor which can choose a rate freely.

[0007] Moreover, although the suction pressure and the discharge pressure of a screw mold compressor were detected, the central value of the ratio of specific beat of gas was conventionally used and calculated to the ratio and it was asking for Optimum Vi, since the screw mold compressor had injected the oil inside in fact, the basis using the ratio of specific beat was thin, and this was what is only a theoretical value to the last.

[0008] This invention is highly precise by detecting a pressure just before the space made from Rota and a casing wall is open for free passage with regurgitation space, and giving a signal to a step motor so that the difference of this pressure and discharge pressure may be made into min, and it aims at obtaining the adjustable screw mold compressor which need power is small and ends.

[0009] Furthermore, since it was asking for Optimum Vi with the theoretical value calculated thermodynamically as mentioned above conventionally, only macro-control was completed. This invention aims at obtaining Vi adjustable screw mold compressor which can cover the whole duration of service which let one year pass, and can set Vi adjustable valve as the optimal location during a day and a season by calculating the optimum value of Vi based on the inclination analysis of the system which lets between the whole term when a screw mold compressor is operated pass.

[0010] Furthermore, although Vi adjustable valve position is conventionally determined by detecting the location of the piston for this valve drive, since the rod and the piston intervene, the precision is bad [valve position] again. By carrying out direct detection of the Vi adjustable valve position, it is high and this invention also aims precision at obtaining Vi adjustable screw mold compressor which enables the more detailed optimal operation.

[0011]

[Means for Solving the Problem] In Vi adjustable screw mold compressor which has a capacity control valve for this invention making adjustable Vi adjustable valve and the inhalation volume for making the design volume ratio Vi adjustable, and making an inhalation flow rate adjustable While forming a male screw in the rod which penetrates a capacity control valve, forming a scalpel screw in Vi adjustable valve and being made to drive Vi adjustable valve by rotation of said rod A step motor is attached in said rod of the exterior of casing, and it has the configuration which drives this motor with an external signal and can change Vi automatically.

[0012] Moreover, in order to set up Vi from which need power serves as min in Vi adjustable screw mold compressor which has aforementioned Vi adjustable valve and an aforementioned capacity control valve, this invention attaches a pressure sensor in a casing wall side just before the space made from Rota and a casing wall is open for free passage with regurgitation space, and has the configuration which gives a signal to a step motor so that the difference of the pressure and discharge pressure which are detected by this pressure sensor may be made into min.

[0013] Moreover, in Vi adjustable screw mold compressor which has aforementioned Vi adjustable valve and an aforementioned capacity control valve, this invention performs inclination analysis with the control unit equipped with the data recorder and the arithmetic unit for parameters, such as suction pressure of the system by which a screw mold compressor is operated, and a discharge pressure, predicts Optimum Vi, and has the configuration which sets Vi adjustable valve as this value of Vi.

[0014] furthermore, the slot where the taper attached this invention to Vi adjustable valve in Vi adjustable

screw mold compressor which [redacted]s aforementioned Vi adjustable valve and [redacted]aforementioned capacity control valve -- preparing -- the casing exterior -- a variation rate -- a sensor is attached so that the clearance between this slot may be detected, and it has the configuration which pinpoints Vi adjustable valve position with the variation rate of this clearance.

[0015]

[Function] By driving a step motor with an external signal and rotating a rod, Vi adjustable valve is moved suitably forward and backward, and Vi is adjusted automatically.

[0016] Moreover, power which drives a screw mold compressor is made into min by giving a signal to a step motor so that the difference of the pressure and discharge pressure which are detected may be made into min with the pressure sensor formed in the casing wall side just before the space made from Rota and a casing wall is open for free passage with regurgitation space.

[0017] Moreover, by carrying out inclination analysis of the suction pressure of the system by which a screw mold compressor is operated, and the discharge pressure with the control unit equipped with the data recorder and the arithmetic unit, Optimum Vi is predicted, and this value of Vi is inputted into a step motor, and is driven.

[0018] Furthermore, Vi adjustable valve position is correctly pinpointed by detecting the clearance between said slots with the displacement gage which prepared the slot which the taper attached to Vi adjustable valve, and was formed in the exterior of casing.

[0019]

[Example] An example explains this invention.

[0020] In drawing 1 in 1, an inhalation hole and 2 a discharge opening and 4 for casing and 3 A regurgitation port, The rod by which Vi adjustable valve and 7 are carried out with a step motor, and the rotation drive of 11 is carried out [5] for a capacity control valve and 6 with a step motor 7, The male screw with which 12 was formed in the edge of a rod 11, the piston rod to which 13 moves the capacity control valve 5 approximately, The hollow hole with which 14 was drilled by the oil pressure piston and 15 was drilled by the piston rod 13, As for the rod by which 16 was ****(ed) by the oil hydraulic cylinder and 17 was ****(ed) in the hollow hole 15, the spiral sulcus by which 18 was formed in the peripheral surface of a rod 17, and 21, a displacement-sensor mounting hole, and 22 and 23 are the feeding-and-discarding outlets of the hydraulic oil to an oil hydraulic cylinder 16. In addition, in the drawing, the male scalpel rotor held in a cylinder 2 is omitted.

[0021] Next, actuation of this example is explained.

[0022] After the fluid inhaled from the inhalation hole 1 is compressed by the male scalpel rotor into casing 2, it is breathed out by the discharge opening 3 through the regurgitation port 4.

[0023] When it is necessary to change the design volume ratio Vi which is a ratio of suction pressure and a discharge pressure, a step motor 7 operates. Drawing 1 shows the condition of being in the location where the Vi adjustable valve 6 moved forward most (a drawing top is ****). When it is necessary to retreat this Vi adjustable valve 6 now (a drawing top is ****), the Vi adjustable valve 6 is made to retreat by rotating a rod 11 with a step motor 7 by screwing with the scalpel screw 10 and the male screw 12 of a rod 11 which were formed in the Vi adjustable valve 6. Under the present circumstances, the capacity control valve 5 retreats with retreat of the Vi adjustable valve 6 with the oil pressure in an oil hydraulic cylinder 16, and when the Vi adjustable valve 6 is fixed to the location set up newly, where this adjustable valve 6 is contacted, it is fixed again. Thereby, the tip of the capacity control valve 5 retreats to the location corresponding to Vi after modification, and specifies whenever [opening / of the regurgitation port 4] newly.

[0024] Since the oil pressure piston 14 carries out advance actuation based on that control command and only an initial complement advances the capacity control valve 5 in case the load applied to a screw mold compressor in this condition was changed and a displacement control is needed, the fluid in the middle of compression is bypassed from the gap of the Vi adjustable valve 6 and the capacity control valve 5 to an inlet side.

[0025] The pin projected from the oil pressure piston 14 can engage with the spiral sulcus 18 of a rod 17, and the magnitude of order migration of the oil pressure piston 14 can detect [the magnitude of the angle of rotation of a rod 17] now with high degree of accuracy.

[0026] Drawing 2 explains location detection of the Vi adjustable valve 6. In addition, drawing 2 is drawn so that the location of drawing 1 and the Vi adjustable valve 6 may be in agreement. The edge of a piston rod 13 is fixed to the edge of the capacity control valve 5 with a locking bolt 25. A nut 26 is fixed.to the edge in

which the male screw 12 of a[redacted]11 was formed with a bolt 27. 8 is the slo[redacted]h a taper formed in the bottom surface part of the Vi adjustable valve 6, inserts and attaches a displacement sensor (not shown) from the displacement-sensor mounting hole 21 from the exterior of casing 2, and detects the location of the Vi adjustable valve 6 by the slot 8 and the displacement sensor. A displacement sensor is attached so that the clearance between slots 8 may be detected, and it can pinpoint the location of the Vi adjustable valve 6 by detecting the variation rate of this clearance.

[0027] Next, the drive approach of a step motor 7 is explained in drawing 1 . 9 is the pressure-sensor attachment section and is prepared in the casing wall side just before the space made from Rota and a casing wall is open for free passage with regurgitation space. While this pressure sensor detects the above "the pressure in front of a free passage" Pd 1, the discharge pressure Pd 2 in a discharge opening 3 is detected, and it asks for difference deltaP of both pressures, and a signal is given to a step motor 7 so that the value of this deltaP may be made into min. thus, the signal corresponding to various kinds of service conditions is immediately transmitted to a step motor 7, and a step motor 7 drives, and the optimal by carrying out, -- Vi is set up promptly.

[0028] Furthermore, other drive approaches of a step motor 7 are explained. Although there are various things in the factor which influences the value of the design volume ratio Vi, the OAT of the system by which a screw mold compressor is operated, a circulating water temperature, time, suction pressure, a discharge pressure, Vi adjustable valve location, a capacity control valve location, ampere (compressor motor), etc. are selected as a parameter of inclination analysis. The inclination which also includes time difference by the factor analysis by weighting and regression analysis as the analysis approach is analyzed, and operation-ization of the inclination by the least square method is adopted further. In drawing 1 , the control device 30 is equipped with the function of the screen output 35 grade of data storage 31, factor analysis 32, the operation-expression-izing 33, the controlled-variable output 34, measured value, and a controlled variable, by carrying out inclination analysis of the signal of said parameter, it predicts Optimum Vi, inputs the signal of this value of Vi into a step motor 7, carries out the rotation drive of the rod 11, and sets the location of the Vi adjustable valve 6 as the optimal location. By doing in this way, the optimal Vi value will always be set up through between the use whole term during a day and a season through one year. Moreover, the count of a motion of the Vi adjustable valve 6 is become empty and lost, and the dependability of a sliding part can be increased.

[0029] Drawing 3 and drawing 4 are the same examples as the case of above mentioned drawing 1 and above mentioned drawing 2 , and it is only that the location of the Vi adjustable valve 6 is only different. That is, drawing 3 shows the condition of being in the location where the Vi adjustable valve 6 retreated most (a drawing top is ****). When the need of changing Vi from this condition by fluctuation of a service condition is produced, the Vi adjustable valve 6 is made to move forward with a step motor 7. In this case, the Vi adjustable valve 6 presses the capacity control valve 5 by that end face, and is made to move forward to one. It is the same as that of the above that the setting location of the Vi adjustable valve 6 is detected by the displacement sensor currently installed in the displacement-sensor mounting hole 21.

[0030] Drawing 5 is the perspective view of the Vi adjustable valve 6, and the scalpel screw which 19 screws with the through tube of a piston rod 13, and 10 screws with the male screw 12 of a rod 11, and 8 are slots with a taper.

[0031]

[Effect of the Invention] Since this invention forms a male screw in the rod which penetrates a capacity control valve, forms a scalpel screw in Vi adjustable valve on the other hand, and screws both and it was made to rotate a rod with the step motor of the exterior of casing, by driving a step motor with an external signal, it can move Vi adjustable valve forward and backward, and can change Vi automatically and correctly.

[0032] Moreover, since the pressure sensor is formed in the casing wall side just before the space made from Rota and a casing wall is open for free passage with regurgitation space, by giving a signal which makes this differential pressure min for the pressure detected by this pressure sensor as contrasted with a discharge pressure to a step motor, this invention can set up correctly and quickly the value of the optimum Vi from which need power serves as min, and can operate Vi adjustable valve.

[0033] Moreover, this invention can cover the whole duration of service which let one year pass, and can make Vi adjustable valve always set it as the optimal location during a day and a season by performing inclination analysis and calculating the optimum value of Vi with the control unit equipped with the data recorder and the arithmetic unit for parameters, such as suction pressure of the system by which a screw

mold compressor is operated, a discharge pressure.
[0034] Furthermore, since this invention can carry out direct detection of this valve position by linkage with the displacement gage which establishes a taper slot in Vi adjustable valve, and is formed in the casing exterior, it can determine Vi adjustable valve position as a parameter in inclination analysis in a high precision, and it is useful to the optimal operation.

[Translation done.]

* NOTICES *
JPO and NCIPI are not responsible for any damages caused by the use of this translation.
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view which cut the equipment of one example of Vi adjustable screw mold compressor of this invention at the perpendicular flat surface containing the mid gear of a capacity control valve and Vi adjustable valve.
[Drawing 2] It is the enlarged detail for Vi adjustable valve portion of drawing 1 .
[Drawing 3] Cutting [and] the equipment of one example of Vi adjustable screw mold compressor of this invention at the perpendicular flat surface containing the mid gear of a capacity control valve and Vi adjustable valve, drawing 1 is the sectional view showing a different capacity control valve and different Vi adjustable valve location.
[Drawing 4] It is the enlarged detail for Vi adjustable valve portion of drawing 3 .
[Drawing 5] It is the perspective view of Vi adjustable valve.
[Description of Notations]
1 Inhalation Hole
3 Discharge Opening
4 Regurgitation Port
5 Capacity Control Valve
6 Vi Adjustable Valve
7 Step Motor
8 Slot
9 Pressure-Sensor Attachment Section
10 Scalpel Screw
11 Rod
12 Male Screw

[Translation done.]